What is Claimed is:

1. An apparatus for separating a first gas from a mixture of the first gas and at least one second gas, the apparatus comprising:

a housing which comprises an inlet port and an outlet port;

an adsorbent which is positioned in the housing;

the adsorbent comprising a carbon based foam monolith that has an affinity for the first gas;

wherein as the gas mixture flows through the housing, the first gas will be adsorbed onto the adsorbent and the second gas will exit the housing through the outlet port;

whereby the first gas is separated from the second gas.

2. The apparatus of claim 1, wherein the adsorbent comprises a thermal conductivity of at least 100 W/m-K.

3. The apparatus of claim 2, wherein the adsorbent comprises a thermal conductivity of at least about 150 W/m-K.

4. The apparatus of claim 1, wherein the adsorbent comprises a mesophase pitch-based graphitic foam product.

5. The apparatus of claim 4, wherein the adsorbent comprises a mesophase pitch-based activated graphitic foam product.

6. The apparatus of claim 1, wherein the adsorbent comprises a number of gas flow passages extending therethrough.

7. The apparatus of claim 6, wherein the passages are aligned with at least one of the inlet and outlet ports.

8. The apparatus of claim 1, wherein the adsorbent comprises at least one cross sectional dimension which is smaller than a corresponding cross sectional dimension of the housing.

9. The apparatus of claim 8, wherein the adsorbent comprises two cross sectional dimensions which are each smaller than the corresponding cross sectional dimensions of the housing.

10. The apparatus of claim 9, wherein the adsorbent comprises means for supporting the adsorbent within the housing.

11. The apparatus of claim 10, wherein the supporting means comprises a number of elongated fins which are each aligned with at least one of the inlet and outlet ports.

12. The apparatus of claim 1, further comprising means for desorbing the first gas from the adsorbent.

13. The apparatus of claim 12, wherein the desorbing means comprises:

a first electrical conductor which is positioned against a first surface of the adsorbent;

a second electrical conductor which is positioned against a second surface of the adsorbent; and

a power supply which is connected across the first and second conductors;

wherein upon activation of the power supply an electrical current is conducted across the adsorbent to desorb the first gas from the adsorbent in a desorption reaction.

14. The apparatus of claim 13, wherein the desorption reaction is substantially non-thermal.

15. The apparatus of claim 13, wherein the housing comprises the first and second conductors.

16. The apparatus of claim 15, further comprising a number of cooling fins attached to at least one of the first and second conductors.

17. The apparatus of claim 12, wherein the desorbing means comprises a heater.

18. The apparatus of claim 17, wherein the heater comprises an electrical resistance heater.

19. The apparatus of claim 17, wherein the heater comprises a cylindrical outer diameter and the adsorbent comprises a generally circular cross section having an inner diameter which is approximately the same as the outer diameter of the heater.

20. The apparatus of claim 17, wherein the housing comprises an annular inner diameter and the adsorbent comprises a generally circular cross section having an outer diameter which is less than the inner diameter of the housing.

21. An apparatus for separating a first gas from a mixture of the first gas and at least one second gas, the apparatus comprising:

a housing which comprises an inlet port and an outlet port;

an adsorbent which is positioned in the housing;

the adsorbent comprising a carbon based foam monolith that has an affinity for the first gas; and

means for desorbing the first gas from the adsorbent;

wherein during a first phase of operation of the apparatus the first gas is adsorbed onto the adsorbent to separate the first gas from the second gas, and during a second phase of operation of the apparatus the first gas is desorbed from the adsorbent and expelled through the outlet port.

22. The apparatus of claim 21, wherein the desorbing means comprises:

a first electrical conductor which is positioned against a first surface of the adsorbent;

a second electrical conductor which is positioned against a second surface of the adsorbent; and

a power supply which is connected across the first and second conductors;

wherein upon activation of the power supply an electrical current is conducted across the adsorbent to desorb the first gas from the adsorbent in a desorption reaction.

23. The apparatus of claim 22, wherein the desorption reaction is substantially non-thermal.

24. The apparatus of claim 22, wherein the housing comprises the first and second conductors.

25. The apparatus of claim 24, further comprising a number of cooling fins attached to at least one of the first and second conductors.

26. The apparatus of claim 21, wherein the desorbing means comprises a heater.

27. The apparatus of claim 26, wherein the heater comprises an electrical resistance heater.

28. The apparatus of claim 26, wherein the heater comprises a cylindrical outer diameter and the adsorbent comprises a generally circular cross section having an inner diameter which is approximately the same as the outer diameter of the heater.

29. The apparatus of claim 26, wherein the housing comprises an annular inner diameter and the adsorbent comprises a generally circular cross section having an outer diameter which is less than the inner diameter of the housing.

30. The apparatus of claim 21, wherein the adsorbent comprises a thermal conductivity of at least 100 W/m-K.

31. The apparatus of claim 30, wherein the adsorbent comprises a thermal conductivity of at least about 150 W/m-K.

32. The apparatus of claim 21, wherein the adsorbent comprises a mesophase pitch-based graphitic foam product.

33. The apparatus of claim 32, wherein the adsorbent comprises a mesophase pitch-based activated graphitic foam product.

34. The apparatus of claim 21, wherein the adsorbent comprises a number of gas flow passages extending therethrough.

35. The apparatus of claim 34, wherein the passages are aligned with at least one of the inlet and outlet ports.

36. The apparatus of claim 21, wherein the adsorbent comprises at least one cross sectional dimension which is smaller than a corresponding cross sectional dimension of the housing.

37. The apparatus of claim 36, wherein the adsorbent comprises two cross sectional dimensions which are each smaller than the corresponding cross sectional dimensions of the housing.

38. The apparatus of claim 37, wherein the adsorbent comprises means for supporting the adsorbent within the housing.

39. The apparatus of claim 38, wherein the supporting means comprises a number of elongated fins which are each aligned with at least one of the inlet and outlet ports.

40. A method for separating a first gas from a mixture of the first gas and at least one second gas, the method comprising:

flowing the gas mixture over or through an adsorbent which has an affinity for the first gas;

adsorbing the first gas onto the adsorbent;

stopping the flow of the gas mixture; and

desorbing the first gas from the adsorbent;

wherein the adsorbent comprises a carbon based foam monolith.

41. The method of claim 40, wherein the adsorbent comprises a thermal conductivity of at least 100 W/m-K.

42. The method of claim 41, wherein the adsorbent comprises a thermal conductivity of at least about 150 W/m-K.

43. The method of claim 40, wherein the adsorbent comprises a mesophase pitch-based graphitic foam product.

44. The method of claim 43, wherein the adsorbent comprises a mesophase pitch-based activated graphitic foam product.

45. The method of claim 40, wherein the desorption step comprises using an electrical current to desorb the first gas from the adsorbent.

46. The method of claim 45, wherein the desorption step is substantially non-thermal.